

Focus on  $\triangle CXF$ .

Apply the tangent ratio to find CF.

$$\tan \angle X = \frac{CF}{CX}$$

$$\tan = \frac{CF}{96}$$

$$96 \tan 61^\circ = CF$$

$$173.2 \div CF$$

The cliff is about 173 m high.

Side View

F

X 61° C  
96 m

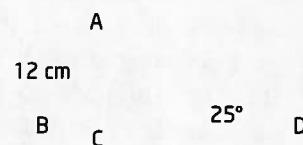
Multiply both sides by 96.

### Key Concepts

- Angles of elevation and depression are measured above and below a horizontal line, respectively.
- The primary trigonometric ratios can be applied to solve two-dimensional and three-dimensional problems involving right triangles.
- Some complex problems involve working with more than one right triangle.

### Communicate Your Understanding

- 1 a) What is an angle of elevation?  
b) How is it measured?
- 2 a) What is an angle of depression?  
b) How is it measured?
- 3 a) What triangles can you identify in the diagram?  
b) Describe the steps you would use to find the side length CD.



### Practise

For help with questions 1 and 2, see Example 1.

1. A telephone pole is secured at its top with a guy wire, as shown. The guy wire makes an angle of  $70^\circ$  with the ground and is secured 5.6 m from the bottom of the pole. Find the height of the telephone pole.



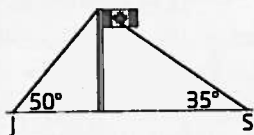
2. a) Find the length of the guy wire in question 1.  
b) Use a different method to find the length of the guy wire in question 1.

For help with questions 3 to 7, see Example 2.

3. Refer to question 1. A second guy wire is to be added to support the pole. It is to be secured on the ground twice as far from the pole as the first wire, on the same side of the pole and attached to the top of the pole.
  - a) Draw a diagram illustrating the telephone pole and both guy wires.
  - b) Find the length of the second wire and the angle it will make with the ground.
  - c) Find the angle formed between the two wires at the top of the pole.

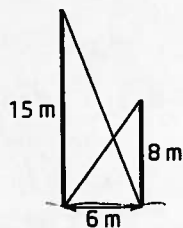
4. Refer to question C3. Solve for side length CD. Record your answer to the nearest centimetre.

5. Jack and Sangita are facing each other on opposite sides of a 10-m flagpole. From Jack's point of view, the top of the flagpole is at an angle of elevation of  $50^\circ$ . From Sangita's it is  $35^\circ$ .



How far apart are Jack and Sangita?

6. Alexa and Emma are looking up at their house from the backyard. From Alexa's point of view, the top of the house is at an angle of elevation of  $40^\circ$ . From Emma's point of view, directly closer to the house, it is  $60^\circ$ . The house is 15 m high. How far apart are the two girls?



7. At the bottom of a ski lift, there are two vertical poles: one 15 m tall and the other 8 m tall. The ground between the poles is level, and the bases of the poles are 6 m apart. The poles are connected by two straight wires.

- a) What angle does each wire make with the ground?
- b) What is the length of each wire?

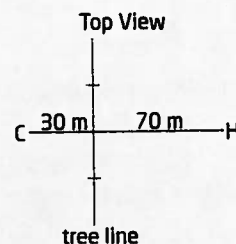
8. Refer to question 7.

- a) Use a different method to answer part b).
- b) At what height above the ground do the wires intersect, to the nearest tenth of a metre?

## Connect and Apply

Use this information to answer questions 9 and 10.

Cheryl is golfing. She is 100 m from the hole, which is her target. Blocking her direct path is a line of trees, the midpoint of which is 30 m from her current position. She has two choices:



- Option 1: Aim directly for the hole, over the trees.
- Option 2: Go around the trees in two shots.

Cheryl's average distances using various clubs are shown in the table.

Club	Distance (m)
Lob wedge	25
Sand wedge	50
Pitching wedge	90
9-Iron	100

9. Cheryl considers Option 1, to aim over the trees. The closest tree, which is in line with the hole, is about 30 m away, as shown. She estimates that the angle of inclination from her ball to the top of the tree is about  $40^\circ$ . She judges that the maximum height she can hit from this position is 20 m. Should she take this shot? Explain why or why not.

